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10/611,978	07/03/2003	Hideo Fujiwara	239658US23X	4244

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EXAMINER	
CHEN, TIANJIE	
ART UNIT	**PAPER NUMBER**
2627	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/611,978	FUJIWARA ET AL.	
	Examiner	Art Unit	
	Tianjie Chen	2627	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 June 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21,23,24 and 26-39* is/are pending in the application.

4a) Of the above claim(s) *9-12 and 30-38* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,13-21,23,24,26-29,39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Final Rejection (RCE)

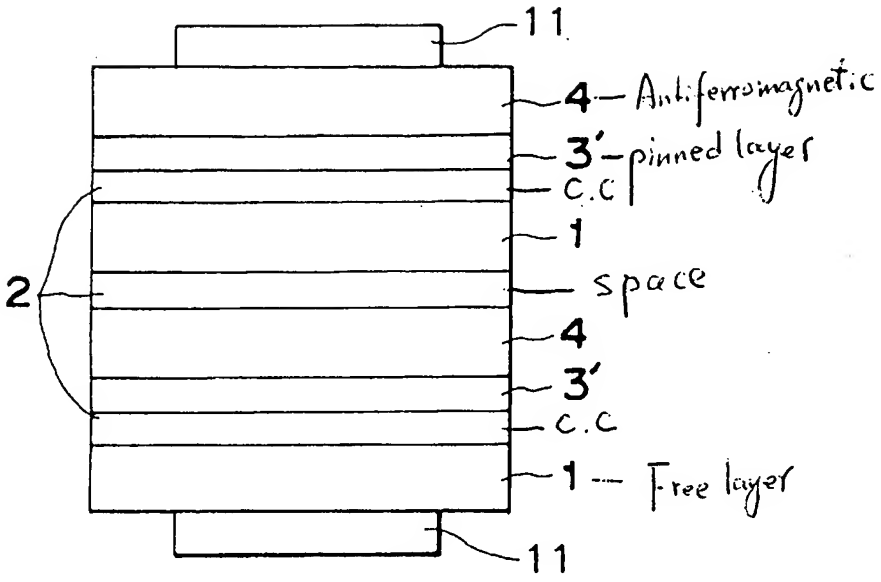
Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. Claims 1-8 and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Sakakima et al (US 5,715,121).

Claim 1, Sakakima et al shows a CPP spin-valve element with two electrodes 11 and 11 (Column 3, line 20) formed on an inherent substrate (See Fig. 5 attached in next page and column 5, lines 4 – 49) including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer (column 4, lines 376-39); a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer to prevent a magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and wherein at least two current-confining (CC) layer structures 2 including at least two parts 21 and 22 having significantly different current conductivities (Fig. 2A and 2B, column 3, lines 44-46); wherein each of the at least two CC layer structures is located on a different side of the thin non-magnetic spacer layer.



Claim 2, Sakakima et al further shows that the pinned layer structure comprises a ferromagnetic layer 3' exchange coupled with an antiferromagnetic layer 4 (Column 5, lines 34-42).

Claim 3, Sakakima et al shows in Fig. 2A that the CC-layer structure includes a mosaic structure of conducting and insulating parts (Column 3, lines 44-46).

Claims 4 and 6, Sakakima et al further shows that the mosaic structure includes metal and oxide (Column 4, lines 8-20).

Claims 5 and 7, Sakakima et al shows that the metal is Cu, the oxide is an oxides of A1 (Column 4, lines 8-20).

Claim 8, Sakakima et al further shows in Fig. 5 attached above that one of the CC-layer structures is located in the vicinity of the free layer structure, and another of the CC-layer structures is located in the vicinity of the pinned layer structure.

Claim 39, Sakakima et al shows the CC-layer structures are fabricated.

A "product by process" claim is directed to the product per se, no matter how actually made, see In re Hirao, 190 USPQ 15 at 17 (footnote 3 CCPC, 5/27/76); In re Brown, 173 USPQ 685 (CCPA 5/18/72); In re Luck, 177 USPQ 523 (CCPA, 4/26/73); In re Fessmann, 180 USPQ 324 (CCPA, 1/10/74); In re Thorpe, 227 USPQ 964 (CAFC, 11/21/85). The patentability of the final product in a "product by process" claim must be determined by the product itself and not the actual process and an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. In instant case, "with a lithography technique using a focused ion beam or an electrochemical scanning probe" is a process related limitation, which gains no weight in determining patentability.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 13, 15, 19, 21, 23, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of Carey et al (US 6,686,068).

Claims 13 and 19 Carey et al shows that the width of the confined current paths of the CC-layer structures is about $2^{1/2}$ times the width of the layer (Since the conductor has volume percentage of 60%, column 5, line 22-24), the width of the layer is 50nm (Column 5, lines 50-54). The confined current paths of the CC-layer structures is about $(0.6)^{1/2}$ X 50 nm =39nm. Sakakima shows that the thickness of the free layer is t=10 nm (Column 7, lines 47-48) and $t^{3/2}$ =31.7 nm. It shows that the

width of the confined current paths of the CC-layer structures is greater than $t^{3/2}$.

Claim 15, Carey et al shows that at least one confined-current path is formed within every flux path of a width of an exchange length of the free layer except at side edge of the free layer since both application and reference have same structure.

Claim 19, as described above, Carey et al shows a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and a thin non-magnetic current confining CC-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between the free and pinned layer structures, and to allow an electric current to go through the confined current paths; wherein the width of the confined current paths of the CC-layer structure is about 35nm.

Claim 23, as described above, the width of the confined current paths of said first and second CC-layer structures is greater than $t^{3/2}$, where t is the thickness of at measured in nanometers.

Claim 28, as described above, Sakakima et al and Carey et al shows a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; and a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; wherein at least one CC-layer structure incorporated therein, which is configured to separate the free and pinned lavers and to allow an electric current to go through the confined current paths, the width of the confined current paths of said first and second CC-layer structures is greater than $t^{3/2}$, where t is the thickness of at measured in nanometers.

Claim 21, as described above, Sakakima et al and Carey et al show a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and a first thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between the free and pinned layer structures, and to allow an electric current to go through the confined current paths; wherein a second CC-layer structure placed across at least one of the free layer and the pinned layer; wherein conducting parts of said CC-lavers are located in a cascade manner (Figs 2A and 2B) and at least an inner edge to edge distance of a projection of the conducting parts of the CC-lavers forming at least one of the current paths through said free layer structure or said pinned layer onto the layer plane, which is 39nm, is made greater than the thickness of at least one of said free layer structure, which is 10 nm.

3. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of AAPA (Applicant Admitted Prior Art).

Claim 16; AAPA shows in P. 18 "a pair of CC-layer structures are located on both sides across the free layer structure or the pinned layer whose conducting parts are located in a cascade manner, and at least the inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through at least one of the free layer structure and the pinned layer onto the layer plane is made greater than the thickness of at least one of the free layer structure and the pinned layer;" and it would provide high magnetoresistance ΔR.

One of ordinary skill in the art would have been motivated to apply this relation into Sakakima et al's device for obtaining high magnetoresistance ΔR.

4. Claims 14, 20, 24 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of Carey et al as applied to claim 21 above, and further in view of Kamijo (US 6,819,532).

Claims 14, 20, 24 and 29, Sakakima et al shows that the thickness of the free layer is 10 nm as described above and Sakakima et al further shows that various changes and modification are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention (Column 8, lines 24-27). Kamijo shows a magnetic head wherein the thickness if the free layer is to be in the range of 1-10 nm (Column 19, lines 1-2). One of ordinary skill in the art would have been motivated to include this thickness range of free layer as the scope of Sakakima et al's device. If take t=5 nm, then the width of the confined current paths of said first and second CC-layer structures is greater than two times of $t^{3/2}$, where t is the thickness of at measured in nanometers.

5. Claims 17, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of AAPA (Applicant Admitted Prior Art).

Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al and Carey et al in view of AAPA (Applicant Admitted Prior Art).

Claim 17, 18, 26, and 27; AAPA shows in Applicant's Specification p. 17 the length of at least one of the current paths through at least one of the free layer structure and the pinned layer structure is greater than the spin diffusion length in at least one of the free layer structure and the pinned layer structure and is smaller than 3/or 2 times as large as the spin diffusion length of the current paths. Since AAPA

show it is an optimized number, one of ordinary skill in the art would have been motivated to apply this relation into Carey et al's for optimizing the performance of the device.

Response to Arguments

1. Applicant's arguments filed on 06/05/2007 have been fully considered but they are not persuasive.

- Applicant argues "Sakakima et al. are not believed to anticipate Claim 1 as amended and the 35 U.S.C. § 102(e) rejection should be withdrawn. "
- Examiner's position: Sakakima et al. anticipates Claim 1 as shown in the drawing attached above.
- Applicant argues "Regarding Claims 19, 21, and 28, the official action asserts that that Carry et al. remedy the deficiency of Sakakima et al. In particular, the official action asserts that Carry et al teach a configuration where the width of the confined current paths of said CC-layer structure is greater than $t^{3/2}$ where t is the thickness of at least one of the free layer structure and the pinned layer measured in nano-meters. Applicants respectfully traverse. Applicants point out that what the official action identifies as the size of the CC path is true if there is only one CC path in an element of 500 A x 500 A and the metal grains grew a pillar with the same size from the bottom to the top. However, what affects the current confinement most is the size of the pillar contacting directly to the ferromagnetic layer. Therefore, the effective size of the pillar of such a metallic grain may be much smaller than the estimated value in the office action, as is shown schematically in Fig. 2 - Figs. 5 of Carry et al."

- Examiner's position: (1) in calculation, the assumption of "an element of 500 A x 500 A" is not necessary. (2) if the metal grains grew a pillar is not in the same size from the bottom to the top; then the width of the confined current path at the wider portion of the grain will be greater than the calculated number. The limitation will be better met.

- Rejection maintains.

Conclusion

2. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tianjie Chen whose telephone number is 571-272-7570. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa Nguyen can be reached on 571-272-7579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Chen Tianjie

TIANJIE CHEN
PRIMARY EXAMINER